COGNITIVE-LINGUISTIC FLEXIBILITY AND AGING

Register No: 05SLP019

VIJAY KUMAR

A Dissertation Submitted in Part Fulfillment of
Final year M.Sc (Speech - Language Pathology)
University of Mysore, Mysore.

ALL INDIA INSTITUTE OF SPEECH AND HEARING
NAIMISHAM CAMPUS, MANASAGANGOTHRI
MYSORE-570006
MAY-2007

CERTIFICATE

This is to certify that this dissertation entitled *"Cognitive-Linguistic Flexibility and Aging"* is the bonafide work submitted in part fulfillment for the degree of Master of Science (Speech Language Pathology) of the student (Registration No. 05SLP019). This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysore

May, 2007

Dr. Vijayaiakshmi Basavaraj
Director
All India Institute of Speech and Hearing
Manasagangothri, Naimisham Campus
Mysore-570 006

CERTIFICATE

This is to certify that the dissertation entitled ***"Cognitive-Linguistic Flexibility and Aging***" has been prepared under my supervision and guidance. It is also certified that this has not been submitted earlier in any other University for the award of any Diploma or Degree.

Guide

Prema KS 30/4/07

Mysore

May, 20007

(Dr. K. S. Prema)
Professor of Language Pathology
Department of Speech-Language Sciences
All India Institute of Speech and Hearing
Mysore-570006

DECLARATION

This is to certify that this dissertation entitled ***"Cognitive-Linguistic Flexibility and Aging"*** is the result of my own study under the guidance of Dr. K. S. Prema, Professor of Language Pathology, Department of Speech-Language Sciences, All India Institute of Speech and Hearing, Mysore, and has not been submitted in any other university for the award of any diploma or degree.

Mysore

May, 2007 Register No. 05SLP019

DEDICATED
TO
PARENTS & GUIDE

ACKNOWLEDGEMENT

I express my deepest gratitude and heartfelt thanks to Dr. Prema, K. S., Professor, Department of Speech Pathology, All India Institute of Speech And Hearing, Mysore for all her inspiration, encouragement, guidance, comments, patient listening and untiring efforts in steering me through every phase of this study.

Thanks is too small a word for your unconditioned encouragement, faith and support, which has made me a different individual, I ***miss you ma****'am...wishing for your showers of blessings forever.*

I would like to thank ***Dr. Vijayalakshmi Basavaraj,*** *Director, AIISH, Mysore, for permitting me to carry out this dissertation.*

I am thankful to Dr. S. R. Savithri, HOD, Department of Speech-Language Sciences, All India Institute of Speech And Hearing, Mysore for permitting me to carry out this study. Ma 'am thanks for suggestions and encouragement you have given to me.

Heartfelt thanks to my beloved ***"Dada and Didi".*** *Thank you for your love, trust, & constant motivation. Your confidence in me pushed me ahead. It's my fortune that I am blessed with the best parents in the world. . . . . Love you lots.*

I express my sincere gratitude to ***all my teachers*** *who have imparted knowledge, moral values and taught the right path in my life.*

I thank the ***Lord of Heavens*** *for giving me strength and courage, to overcome all my difficulties, which made me perfect my weakness.*

My Brother, Sisters, Bhabhi & Jiju, *I realy enjoyed a lot being youngest in the family. Thanks for all the love & affection along with the lessons you taught me about real life. I have the same respect for you all what I have for "Dada & Didi". No words to express gratitude for all the love you have showered on me and for keeping faith in me, for the endless support and encouragement.*

Vivek, Prafful, Mausam, Abhishek, Nikhi, Aswani, Shivani, Aparajita & Kartavya; A lot of love and wishes for you all. *In you all* ***I*** *am visualizing my childhood. Do well in your life. I am sure God's grace will be always with you. Thanks for love respect and being such a wonderful friend.*

Teena, Ruchi *&* ***Kavya...*** *Thanks for your care and love made me feel I am not alone during my Mysore stay. Thanks for all the chats during and after posting. Thanks to Teenafor all her support & trust during last two years especially during ISHA paper. You withdraw best of mine. Thanks a lot.....*

Niraj & Abhay... *I couldn 't have asked for better friends than you guys... thanks for being such wonderful friends and for your moral support. You are some of the rare fortunate guys with whom I used to share my 'Sorrow & Joy'. Miss u guys.....*

Kunal, Shibashis, Bijan, Ravi, Manas, Sumesh, Radz... *thank you guys for your intense help, fun, care, friendship, valuable suggestions, support and encouragement.*

Marylyn, John, Rohini, Sister, Maria *...how can I forget the days we had fun during our postings... Will miss those great days with u guys.*

Special thanks to ***Preeja mam & Baba Fakhniddin*** *for your timely help during my data collection. Only my brother & sister would have done as much as you did.*

Ashutosh, Dhiraj & Prabhash... *I have enjoyed the times with you immensely. I always realized you guys as a good friend, juniors, most importantly I always felt as "younger brother". I appreciate your ever ready attitude to do anything for me. Both of you guys will always be a prominent part of my "sweet memories ofAIISH". Wish you all the best.*

Akshay *&* ***Bharat...wish*** *I could get back those days, which we spent together. I'll cherish those moments spent with you. Love you for the subtle way in which you show your care.*

Specially remembering ***Pravin sir*** *& Sanjay...you get all the credit for what I am today. You have taken real care of me when I needed them. Will miss you all very much.....*

/ would like to remember ***my dear Friend Subhash, Naveen, Babloo, Manjesh*** *who have always inspired me, motivated me and have been there always for me. Thank you all. Hope to meet you all some day.*

Thanks to all my ***B.Sc and M.Sc classmates,*** *for having been a great company all these years. We were a great batch, will miss all the fun we had, especially in the canteen...Best wishes to all of you for a bright future.*

I Thank ***Mr. Shivappa*** *&* ***Co.,*** *for the kind cooperation throughout.....*

TABLE OF CONTENTS

S.No	Title	Page No.
1	INTRODUCTION	1 - 6
2	REVIEW OF LITERATURE	7-22
3	METHOD	23 - 27
4	RESULTS AND DISCUSSION	28 - 45
5	SUMMARY AND CONCLUSION	46 - 52
6	REFERENCES	53-61
	APPENDIX	

LIST OF TABLES

TABLE NUMBER	TITLE	PAGE NUMBER
1.	Study review on the age related decline.	**18**
2.	Distribution of the subjects.	**23**
3.	Average recognition frequency (accuracy in %) across age group.	**29**
4.	Average recognition frequency (accuracy in %) across two sub groups.	**30**
5.	Mean Reaction Time (ms) of Regular and Inserted items across age group.	**31**
6.	Mean Reaction Time (ms) of Regular and Inserted items across two sub groups.	**32**
7.	Mean Reaction Time (ms) across age groups.	**36**
8.	Mean Reaction Time (ms) across two sub groups.	**39**
9.	Vigilance score (%) and Mean Reaction Time (ms) across age groups	**42**
10.	Vigilance score (%) and Mean Reaction Time (ms) across two sub groups.	**43**

LIST OF FIGURES

TABLE NUMBER	TITLE	PAGE NUMBER
1.	Average recognition frequency (accuracy in %) across age group.	**29**
2.	Average recognition frequency (accuracy in %) across two sub groups.	**30**
3.	Mean Reaction Time (ms) of Regular and Inserted items across age group	**31**
4.	Mean Reaction Time (ms) of Regular and Inserted items across sub groups.	**32**
5.	Mean Reaction Time (ms) across age groups.	**36**
6.	Mean Reaction Time (ms) across two sub groups.	**40**
7.	Average recognition frequency (accuracy in %) across age group.	**41**
8.	Mean Reaction Time (ms) across age groups.	**42**
9.	Vigilance score (%) across sub groups.	**43**
10.	Mean Reaction Time (ms) across two major age groups.	**44**

Chapter I

INTRODUCTION

" Without concepts, mental life would be chaotic."

Smith and Medlin, (1981)

Communication is among the most complex of human behaviors. The question of how humans communicate, how the brain functions in communication, and the relationship among language, thought and memory are a few of the most fascinating areas among others. These questions have also been of historic interest to the scientists and common people as well since communication is known to have setbacks with the phenomenon of aging.

Normal aging often refers to the most common or usually encountered functional state of the nervous system in a population of older individuals (Whitehouse, 1991). Aging is associated with special physical, emotional and social burdens imposed by mental decay in later life and a general wear and tear at anatomical and functional levels. Aging is deterioration of a mature organism resulting from time independent, essential irreversible changes intrinsic to all members of species. With the passage of time, the individuals become increasingly unable to cope with the stresses of the environment thereby increasing the probability of death (Handler, 1960). Human aging involves molecular, cellular and biochemical changes across all body systems.

In addition to the physical changes, normal aging is also accompanied by changes in the ability to process, understand and use language. Although, there is no global decline in linguistic functions, decline in certain cognitive functions like attention, memory, recall with increasing age has been reported. A general decline in

reaction time has also been documented. These cognitive changes impinge on linguistic abilities leading to difficulties in word retrieval process (Kemper; 1992); decline in complex discourse processes (Ulatowastia, 1985); slight diminution in language performance in terms of use of semantic information, structures, error of reference, intact phonological and grammatical systems within the clauses; reduction in type of clauses structure and verb phrases used, difficulties in higher level comprehension tasks such as drawing inferences, recalling and detecting verbal anomalies (Cohen, 1979; Cohen and Faulkener, 1981).

Among many other changes seen with aging, attention and memory process deficits are most commonly investigated. There are many studies to suggest that the elderly have problems in language and memory functions. While a few studies show that newly learned items are available to older adults with some reduction in the ability to access those items because of difference in either the storage or their retrieval (Craik and Rabinowitz, 1984), the others state that confrontation naming is affected in old age (Carr, Mccarley, & Sperber, 1982). Age related encoding deficits have also been identified in semantic memory employing tasks that manipulate verbal or visual elaboration and stimulus organization. A total failure in word retrieval and/or longer retrieval time is also reported (Schonfield and Robertson, 1966).

One of the core prerequisites for memory function is attention. James (1964) found that the ability to maintain attention is important for both linguistic and cognitive processing. Early research suggested that the elderly might have modality specific preferences for attention and that they have greater difficulty in ignoring

irrelevant information. However more recent research points to visual perceptual deficits in the elderly, which are absent in the younger population and which may account for this finding (Davis & Ball, 1989). Eriksen, Hamlin and Daye (1973) found increased reaction time and slow central processing speed with increase in age. Given these deficits in attention and memory and increased reaction time which are the underlying processes for linguistic function, it is highly likely that these cognitive deficits would impair linguistic functions leading to communication impairment in the elderly. Both attention and memory are the core cognitive processes involved in language comprehension and production. If there is finite attentional capacity which reduces with increasing age, then larger attentional demands will lead to larger age related deficits (Hasher and Zacks, 1988).

Cognitive flexibility commonly refers to the ability to shift cognitive set, aptitude, thought, or attention in order to perceive, process or respond to situations in different ways (Eslinger and Graten, 1993). This shifting occurs when either external task conditions or self initiated decision require that an alternative to the current response be chosen and executed (Richards, 1993). Most definitions of cognitive flexibility include the notion of shifting cognitive set as a basic premise, but the nature of the shifting is not always explicitly stated or operationally defined (Downes, Roberts, Sahakian, Evenden, Morris & Robbins, 1989).

The nature of cognitive linguistic flexibility is rarely defined beyond general statement about the ability to shift cognitive linguistic set. There are, however, several aspects of cognitive linguistic flexibility that a clinician need to consider while assessing or treating persons with disordered cognitive functions. Eslinger and

Grattan (1993) emphasized a collective cognitive process contributing to flexible cognitive behavior, such as producing diverse idea, considering response alternatives, and modifying plans and behavior in order to manage changing circumstances and long term goals. Such a characterization of cognitive flexibility connects it to real-life situations and highlights the potentially pervasive functional difficulties in persons with impaired flexibility.

An area that speech language clinician should consider during assessment of persons with impaired flexibility is the form of cognitive linguistic flexibility as per the situational demands. Cognitive linguistic flexibility has been dichotomized into reactive flexibility and spontaneous flexibility that may be differentially impaired in persons with neurogenic communication disorders according to site of lesion. Reactive flexibility is the ability to free shift cognition or behavior in response changing tasks or situational demands. Different tasks and situations require different type of reactive shifts and, presumably, different underlying cognitive processes. Spontaneous flexibility represents the ability to produce diverse ideas, consider response alternatives, and modify plans. Semantic spontaneous flexibility is often described as divergent thinking, which emphasizes variety, quantity, and relevance of information. Divergent thinking is the ability to produce a proliferation of different ideas (Chapey, 1994).

The relevance of flexibility in cognitive as well as linguistic domain has been extensively reported in persons with neurogenic communication disorders. Chapey, Rigrodesky & Morrison (1977) proposed that spontaneous flexibility may be impaired in persons with aphasia. They suggested that person with aphasia who

cannot use flexibility strategies to improve their communication have problem with semantic spontaneous flexibility. Inability to employ cognitive flexibility as a strategy is evident in recurrent perseveratory errors that are often exhibited by persons with aphasia (Estrabrooks and Albert, 1991). Varley (1995) interpreted poor verbal fluency performance in persons with right hemisphere damage as indicative of impaired cognitive linguistic flexibility and decreased ability to use lexical knowledge in flexible ways. It has been reported that persons with closed head injury demonstrated poor letter-cued verbal fluency (Crowe, 1992) and tend to produce recurrent perseverations (Hotz and Helm, 1995). Persons with Parkinson's disease exhibit impaired performance on the tests of category-cued fluency; their ability on letter cued fluency tasks is in question (Bayles, Trosset, Tomodea, Montgomery, & Wilson, 1993).

Putting a name to something quickly and accurately is an essential part of efficient spoken language. It happens so often and so easily that most speakers are unaware of its complexity unless the process goes wrong. Confrontation Naming involves naming in response to pictures (line drawing), photographs or real objects. It is a complex process involving several stages (Wilson and Bayles & Tomocda, 1990).

a) Perceptual stage: Following the presentation of the stimulus, the image of the stimulus is analyzed for correct identification of the stimulus.
b) Semantic stage: Semantic activation is activated.
c) Retrieval stage: Phonological representation corresponding to semantic representation is retrieved.

d) Motor planning stage: Articulatory sequence gets activated.

The phenomenon of naming may serve as the best tool to examine the cognitive linguistic flexibility in geriatric individuals. The reactive flexibility may be examined from a set of category interspersed with nouns from another set and measuring the reaction time for naming series of pictures programmed for the purpose.

Need for the study

According to WHO (1993), India has the second largest population of the world's elderly and the rate of growth of the population aged 60 and above is greater than even the overall rate of growth of the population. The number of very old individuals (80yrs+) is expected to show a four fold rise by the year 2025. This trend is true and representative not just of the Indian population but also the world's population (in millions). Communication being one of the prime requirements for successful living, a Speech-language Pathologist would become a key professional to preserve this skill in the aging population. Therefore, the present study is designed to examine if there are variations in cognitive linguistic flexibility in geriatric individuals.

Objectives of the study

- To study cognitive linguistic flexibility across different age groups.
- To examine the relationship between aging and reaction time for picture naming.

Chapter II

REVIEW OF LITERATURE

(A) AGING

Generally, to age means "to cause to ripen or become mature over a period of time under fixed conditions" (Webster's New World Dictionary, 1970). Text books usually differentiate among biological, psychological and social aging.

a) *Biological aging*

Handler's (1960) defines biological aging as, "Aging is a deterioration of a mature organism resulting from time dependent, essential irreversible changes intrinsic to all members of the species such that, with the passage time, they become increasingly unable to cope with the stresses of the environment, thereby increasing the probability of death." Biological aging is seen as both a program process, reset for every species and subject to only minor modifications, and the result of accumulated insults to the body. On a cellular level, Medvedev (1964) believes that aging is caused by damage to the genetic information involved in the formation of cellular proteins and by errors in the transmission of information from the DNA to the final protein product.

b) Psychological Aging

Birren and Renner (1980) have defined psychological aging as "the regular changes that occur in mature, genetically represented organism living under representative environmental conditions as they advance in chronological age." Psychological aging refers to changes that occur in the ability of the organism to adapt its capacities, e.g., sensation, perception, memory, learning, intellectual

abilities, drives and motivation, to alternatives in the social and physical environment and within the organism itself.

c) Social Aging

It the process of adapting the age roles assigned by society. It refers to process of adjustment to societal norms.

d) *Cognitive Aging*

Cognitive changes related with aging are central to theoretical explanation of observed language processing deficits, with production deficiency and reduced processing capacity as the prevailing explanations for such changes (Bayles & Kasnik, 1987; Cohan & Faulkener, 1981). Briefly stated, the production deficiency theory posits that in text recall experiments, older adults differ from younger adults primarily in the kinds of information they recall. Thus, qualitative, rather than quantitative, changes in text recall ability are observed in aging. Light (1990) supported this explanation by describing a hierarchical effect in text recall, with older results likely to forget less important details but to recall successfully more essential information. Alternatively, processing capacity explanation predict age related differences due to the heavy demand that text processing places on working memory (Craik & Jennings, 1992; Light, 1990; Light & Anderson, 1985).

Working memory is a psychological construct that refers to simultaneous short-term storage and information processing (Baddely & Hitch, 1974). Kintsch and van Dijk's (1978) model of text comprehension features working memory by positing a buffer that holds representation of linguistic units (e.g., propositions) in short term memory long enough for the listener/reader to achieve meaning coherence

between preceding and incoming information. Such processing capacity is presumed to be reduced in older adults (Craik & Jennings, 1992; Light & Anderson, 1985).

Reduced speed of information processing is characteristic among older readers. Speed of information processing serves as a behavioral indicator for reduced processing capacity associated with aging. Researchers infer that self-paced reading time, or reading duration, is the behavioral manifestation of active cognitive processing (Frederiksen Bracewell, Breuleux, & Renaud, 1990). In a study of working memory and cognitive monitoring effects of text recall, Zabrucky and Moore (1994) found a significant age effect of reading time, with older adults taking longer than younger adults to read experimental texts.

Given the inextricable link between cognition and language, it is not surprising that age-related cognitive changes are implemented as a causative factor in reduced linguistic processing abilities. It is remarkable, however, the extent language and aging literature focuses almost exclusively on diminished abilities, without consideration of preserved abilities and more importantly, ways to enhance those abilities (Kemper, 1992). To gain a more complete understanding of text processing in aging, other variables known to influence understanding of written language (e.g., text genre, cognitive processing requirement, comprehension-enhancing strategies) must be empirically tested to assess their influences on performance.

B. Cognitive functioning and reaction time

Data from both simple reaction time studies and choice reaction time paradigms indicate that the single major component responsible for the slowing of reaction times with age is the time required for central information processing. The

apparent slowing of cognitive processes has been referred to as "bradyphrenia" (Rogers, 1986). Using an unique and quite sensitive paradigm developed by Sternberg, slowing of peripheral and central component of reaction time and processing speed can be demonstrated to be present even at the age 50 to 55 (Eriksen, Hamlin, & Daye, 1973). Using this and additional paradigms, slowing of cognitive processes has been found to occur not only in normal elderly, but in patients with Parkinson's disease as well (Mayeux, Stern, Sano, Cote, & Williams, 1987).

C. Naming in Normal Aging

Confrontation naming test typically consists of the presentation of pictured objects that subjects are asked to name. In these tasks, the picture stimulus is thought to directly activate its semantic representation, then to indirectly activate the word name at lexical level (Carr, McCauley, Sperber, & Parmelee, 1982).

The Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1976) is commonly used in testing naming abilities. It consists of simple line drawings of 69 common and less common objects. When Borod, Goodglass, & Kaplan (1980) administered this test to normal young and elderly adults, they found that subjects over 70 years of age named significantly fewer items than younger subjects. Nicholas, Oblar, Albert, and Goodglass (1985) reported similar results for the naming of action pictures. They also found that older subjects more often required phonological cues (the initial sound of target name) to elicit a correct response than did younger subjects. However, young and elderly subjects were equally likely to produce a correct response when they were given a phonological cue (information at

lexical level). In other words, in the absence any phonological information, older subjects had more difficulty in spontaneously retrieving the target word than did younger subjects. When partial phonological information was provided, elderly subjects were just as likely as younger subjects to correctly retrieve the target word.

Bowles and Poons (1985) obtained similar results in a naming to definition experiment with orthographic priming. In this paradigm the stimulus was the definition of a target word of relatively low normative frequency and the task was to name the word that was defined. Each definition was preceded by a priming stimulus that was orthographically related, semantically related, unrelated, or neutral with respect to the target word itself. Elderly adults in every condition, except when the prime was the correct target word or the initial two letters of the target word. In those two conditions the older subjects were as accurate as the young subjects. These results again demonstrate that when partial or complete orthographic/phonological information was provided, no age differentiation in naming was found.

These laboratory results have been confirmed in a more natural setting using structured diary recordings. Burke, Worthley, and Martin (1988) asked participants to report tip-of-tongue experience in the course of daily living. Older subjects reported more such experiences than did young subjects. In another of every day memory, Cohen and Faulker (1986) reported a questionnaire each time a name block occurred in their lives. They found that partial phonological information about a blocked target name was significantly less available for the older adults than for the young adults. Both results support the laboratory data and suggest again that there is

difficulty at lexical level in activating the phonological information necessary to produce a desired word name.

In summary, semantic memory organization and processing, which are inextricably linked to language processing, are for the most part well preserverd throughout the life-span. It has been shown; however, that retrieval of less frequently used word names, in the absence of any phonological or orthographic cues, is somewhat impaired in older adults. This is seen in a greater number of word retrieval failures and in longer retrieval times.

Considerable evidences exist to suggest that naming ability decline with advancing age. One common complaint of elderly people is increased difficulty in finding words in every day speaking and writing. While word recognition is maintained or even increased with age, the ability to access vocabulary appears to decrease with increasing age (Bowels & Poons, 1985). Furthermore, some evidences suggest that object naming, naming latency, and word fluency declines with age (Obler & Albert, 1981). Some discrepancy in the literature exists in characterization of naming abilities in elderly subjects, probably as consequences of the nature of the task accessing lexicon. In contrast to lowered performance on word generation task, elderly adult speakers demonstrated higher performance in the conversational speech as measured by type-token than did younger speakers (Walker 1981). Older adults may display a more varied vocabulary in conversation than they demonstrated on more artificial naming tasks. While incongruity exists in characterization of naming ability in the elderly with advancing age, the difficulty in lexical access appears to be real.

D. Interaction of Cognitive Linguistic Factors

Over the history of the study of aphasia there has been some debate as to whether generalized intellectual deterioration is concomitant with aphasia. Intellectual deterioration in dementia is much marked and clearly interacts with subjects' performance on many tasks. Thus, researchers spend a fair amount of time designing tasks that involve as few interesting cognitive factors as possible. Kempler, Van Lanker, and Read (1988) attempted to separate language and cognition in their study on proverb and idiom interpretation. They designed a test of familiar and novel language comprehension using a picture-pointing response mode. The novel and familiar phrase (idiom and proverb) subtests were matched for length, grammatical structure, and word frequency. According to Kempler et. al., (1987), "decoding word meaning and syntactic structure" was necessary to comprehend novel phrases. Comprehension of familiar phrases was improbable using the above strategy and required "inferring an abstract meaning." Thus they were able to isolate a fundamentally cognitive dysfunction as opposed to a primarily linguistic one in comprehending words and phrases in dementia of Alzheimer type.

These research issues are embedded in a general theoretical view about the extent to which cognition and language are integrally related to each other. Are the two indeed relatively independent? Is language based on non language cognition? Or do the two interact in complex ways? Some researches simply take one of these stances as an assumption and build the research question on that premise, whereas others focus their research on making distinctions between language and cognition.

E. Language and Normal Aging Research

One focus of research on normal aging has been description of the components of language that changes with aging as compared to those that do not. A basic split is seen between studies of language production and comprehension. Language production includes both naming and discourse, in which changes are seen with aging (Botwinic & Storandt, 1974; Bowles & Obler, Albert, & Nicholas, 1985; Bowles & Poon, 1981; Kynette & Kemper, 1986; Obler & Albert, 1985). Comprehension studies test comprehension of single sentence or entire paragraphs, utilizing a number of measures (Bergman, 1971; Cohen, 1979; Davis & Ball, 1989; Obler, Nicholas, Albert, & Woodward, 1985). Other studies have been conducted on more specific areas of language performance. Obler and Albert (1985), for example, considered lexicon, discourse, laterality, and comprehension separately in normal elderly, documenting that "different skills have different life spans of their own." Note that the framing of these research topics assumes a certain modular theory of language with dissociable components, some that changes with age and other that do not. More over, components that change with age may change at different rates.

(B) AGING AND COMMUNICATION

a) Relationship between Communication and Healthy Aging

Communication has a vital role in healthy aging. Communication is inextricably linked to social health and psychological well-being. Social health is defined as "the dimension of an individual's well being that concerns how he gets along with other people, how other people react to him, and how he interacts with social institutions and societal mores" (Russell, 1975, p. 75). Social adjustment, social role, and social support measures are all methods of evaluating social health (Newell, 1987). Psychological well beings is a complex construct that has been termed emotional well beings or mental health. Measures of life satisfaction, affective state, and psychological distress are all methods of assessing psychological well-being.

Communication is the means by which people adapt to life's stresses. It is the thin thread that can bind it all together, and with its vulnerability, older people (as well as policy makers) need to understand the importance of communication to healthy aging. Communication disabilities are certainly less visible than physical disabilities; therefore they are not in the forefront in the peoples minds. People with communication disabilities, particularly those with expressive difficulties, are generally not outspoken lobbyists because of varying nature of their disability. Finally, communication is the gift that often develops naturally in childhood and then may gradually fade away in older adulthood. The link between communication disability and social isolation, however, is an important one; loneliness in older people is a better predictor of death than smoking or cholesterol (Goodman, 1994).

b) Effects of Age-related Communication Changes

Communication is fundamental to older peoples' quality of life for many reasons. Older people need communication to adapt to changes, to maintain friendships, to participate in life, and to learn new things. It is assumed that quality of life depends on communication because it is implicit in many of the core components of quality of life such as participation in relationships, expressions of self, and autonomy. Communication disabilities, therefore, have potential to adversely affect older people's lives in a number of ways. Social withdrawal and feeling of isolation, dependence, and depression have all been reported (Bess, Lichtenstein & Logan, 1989). In a study of communication and quality in healthy older people and people with aphasia, Cabeza (2002) found that older people who had experienced a loss of communication skills generally appreciated the importance of communication as most highly valued. Healthy older people were more likely to take their communication abilities for granted.

The effects of communication changes with age described using the WHO model (2001) or the International Classification of Functioning, Disability, and Health. In this model, the effects of health condition are described in terms of the effects of the body structure and function, activities, and participation. Impairment refers to changes at the body level (e.g. reduced sound acuity); activity limitations are changed at the level of the persons (e.g., inability to hear conversations); and participation restrictions are the effects of these on broader aspects of life

(withdrawing from social situations). Environmental factors (e.g., residential situations) and personal factors (e.g., personality) are also taken into account.

In summary, the increasing number of older people with communication difficulties has major implication for the enhanced role and responsibilities of Speech-Language Pathologist.

c) Picture Naming and Age

Thomas Fozard & Waugh (1977) & Van Gorp, Satz, Kiersch & Henry (1986) have also reported documents in performance for older compared to younger subjects but either did not indicate weather the age-related decline was statistical analyzed to enable such a conclusion to be drawn. Poon and Fozard (1978) did report that old subjects performed significantly worse than younger subjects when asked to name pictures of contemporary objects.

In contrast with those studies having reported an age related decline in picture naming abilities, Beland and Lecours (1990) and Flicker, Ferrish, Crook, & Bartus, (1988) and Mitchell (1989) found no significant correlation between age and picture-naming performance. No age effect was found in the original norms in the Boston Naming test provided by the Kaplan, Goodglass, & Weintrab, (1983). Farmer (1990)

Authors	Study type	Age-related decline	Significant
Albert et. al., 1988	Experimental	Yes	Yes
Ardila & Rosselli, 1989	Experimental	Yes	Yes
Au et al., 1990	experimental	Yes	
Bachy-Langerdock, 1988	Normative	Yes	Yes
Be land & Lecours, 1990	Normative	No	No
Borod et. al., 1980	Normative	Yes	Yes
Bowles et al., 1987	Experimental	Yes	Yes
Dordain et. al., 1983	Experimental	Yes	Yes
Farmer, 1990	Experimental	No	Yes
Flicker et. al., 1987	Experimental	No	No
Goodglass. 1980a	Experimental	Yes	
Kaplan et. al., 1983	Normative	No	
Laberge et. al., 1986	Experimental	Yes	
Le Dorze & Durocher, 1992	Experimental	Yes	Yes
Metz-Lutz et. al., 1991	Normative	Yes	Yes
Mitchell. 1989	Experimental	No	**No**
Montgomery & costa, 1983	Normative	Yes	
Nicholas et al., 1985	Experimental	Yes	Yes
Nicholas et al., 1989	Normative	No	**Yes**
Poon&Fozard, 1978	Experimental	Yes	**Yes**
Rosselli et al., 1990	Experimental	No	**Yes**
Thomas et. al., 1977	Experimental	Yes	**Yes**
Thuillard & assal, 1989	Normative	Yes	**Yes**
Vangropet. al., 1986	Normative	Yes	
Valardita et al., 1985	Experimental	No	**No**

Table 1: Study review on the age related decline.

In summary, aging does not significantly alter picture naming abilities in all of the above mentioned studies. Any conclusion about the age-related effect on picture naming must consider the between-study variability. Large within study variability observed among older subjects (Van Grop et al., 1986) should also be taken into account. Such variabilities are congruent with the suggestion of Goodglass (1980) that only some, but not all, older individuals have picture naming difficulties. For instance, in Dordain, Nespoulous, Bourdeau & Lecours (1983) study, an age-related decline was reported, 41% of the elderly subjects did not produce any picture-naming errors.

d. Subject's Chronological Age

Decline in picture naming cannot be solely attributed to the magnitude of the age differences between young and old subjects. Indeed, Albert, Heller, & Milberg (1988) and Nicholas, Obler, Albert, & Goodglass (1985) reported a significant age effect on picture naming for two contiguous age cohorts (60-69 years versus 70-79 years). Similarly, Le Dorze and Durocher (1992) reported that subjects aged 45 to 64 years performed better than subjects aged 65 to 85 years. Such systematic decline in picture naming with advancing age might be interpretable as a linear change. But contrary to that finding, Nicholas et al. (1989) failed to find a significant correlation between picture naming scores and chronological age among 40 to 78 year old subjects.

According to Albert, Duffy, and Naeser (1987), age related decline in picture naming abilities can be attributed to nonlinear modifications in cognitive function related to selective changes in the brain evolved at differential rates across the life

span. Consequently, another way to address this issue would be to look for particular age at which word finding abilities would be expected to appear.

Albert et al. (1988) and Nicholas et al. (1985) concluded that picture naming difficulties became apparent only when the subjects in their study reached 70 years old. They found that the subjects aged between 70 to 79 years old named significantly fewer pictures than those of younger decades (60s, 50s, 40s, and 30s), but no other significant decline was founded between any two other age decades. Results reported by Thuillard and Assal (1989) are consistent with this finding in that picture naming scores were stable before age 70 but abruptly decreased after 70 years old. Similarly, adults in their 30s named significantly more items than subjects 70 to 79 years of age in Bowels, Obler, Albert (1987). These two decades were the only ages considered in this study. In the same vein, Van Grop et al., (1986) pointed out that mean scores of subjects aged between 59 and 69 years were commensurate with norms of the 60-items version of the Boston Naming Test (Kaplan et al., 1983) provided for younger individuals, whereas scores for the subjects in their 70s and older were consistently lower.

The possibility that age 70 is a critical turning point in picture-naming abilities is also congruent with the finding of Ardila and Rosselli (1989), Au, Obler, Joung, & Albert, (1990) and Borod, Goodglass, & Kaplan, (1980). All of these studies included subjects who were 70 years old and older, and showed an age related effects on picture naming. Neither of these studies provided additional information about the age groups for which lower picture naming scores were found, but Beachy-Langedock (1988), Dordain, Nespoulous, Bourdeau, & Lecours, (1983) showed

picture naming difficulties particularly for age groups including subjects older than 70 years. The hypothesis that picture naming declines only after 70 years of age may also explain why Nicholas et al. (1989) did not reveal a statistically reliable correlation between picture naming scores and ages varying from 40 to 78 years.

In contrast to the "70 years of age hypothesis, " as well as age related decline associated with contrastive age cohorts discussed above, Beland and Lecours (1990) found no difference for picture naming between 19-to 49-and 70-to 87-year -old individuals. Flicker et al. (1987) also failed to find a significant effect of age when comparing 18- to 32-year old subjects with 63-to 83-year old subjects, and Mitchell (1989) reported the same failure when comparing 19-to -32-year old subjects with 63-to 80-years-old subjects. Finally, some studies supporting the presence of an age-related decline can also be put forward against the 70 years of age hypothesis. Rosselli, Ardila, & Rosas (1990) observed a significant age effect among five age cohorts of subjects ranging from 16 to 65 years old, and, as reported earlier, Le Dorze and Durocher (1992) found a similar effect when comparing subjects aged between 60 and 70 years performed less well than students aged between 18 and 22 years. The latter results support the claim of Goodglass (1980a) that over the age of 60, some people do have naming problems.

Reaction time experiments are an effective method for assessing aspects of neurophysiologic integrity of single subjects or groups. There are many forms of the RT paradigm, but the most basic is simple response time, in which subjects react to a stimulus by performing a predetermined task. No decision making or discrimination of the stimulus is involved; there is only one type of stimulus and one response.

Temporal intervals (latencies) are measured from stimulus appearance to response onset. When applied to phonation, vocal reaction time has been studied in normal (Izdebski & Shipp, 1978).

Need for the study

An extensive review of literature on cognitive-linguistic skills and aging suggests that there is a decline in cognitive-linguistic ability in aged population. Further the studies indicate that specific skills such as reaction time as opposed to accuracy of verbal response and word retrieval as opposed to word recognition declines as age advances. Thus, it leads to general impairment in communication.

According to WHO (1993), India has the second largest population of the world's elderly and the rate of growth of the population aged 60 and above is greater than even the overall rate of growth of the population. The number of very old individuals (80yrs+) is expected to show a four fold rise by the year 2025. This trend is true and representative not just of the Indian population but also the world's population (in millions). Communication being one of the prime requirements for successful living, a Speech-language Pathologist would become a key professional to preserve this skill in the aging population. In the absence of such studies on Indian population, the present study is designed to examine if there are variations in cognitive linguistic flexibility in geriatric individuals.

Objectives of the study

- To study cognitive linguistic flexibility across different age groups.
- To examine the relationship between aging and reaction time for picture naming.

Chapter III

METHOD

The aim of the study was to investigate the cognitive-linguistic flexibility in aging population with the help of picture naming task.

A) **Subjects**

60 normal healthy adults (30 males and 30 females) in the age range of 30yrs to 80+ yrs were chosen for the study as shown in Table 2. Those who did not have any history of neurological/psychiatric disorders and with seven years of educational record were selected for the study. Subjects were from different educational, cultural, professional and linguistic background. Starting from VII grader to doctoral degree holders, professionals to house makers, varying cultural backgrounds and linguistically monolingual Malayalam/Kannada/Urdu/Hindi speaker to bilingual/multilingual Hindi/Kannada, Kannada/English, Kannada/English/Hindi, Urdu/Kannada/Hindi/English speakers. The subject population was chosen from the All India Institute of Speech & Hearing (AIISH) Mysore employees, regular therapy seeking clients' parents, AIISH students' parents and grandparents and residents of old age homes. Post retirement life style was also varying from very sedentary to very active life style.

Age group	No. of subjects
30-40 yrs	10(5 M +5 F)
40-50 yrs	10(5M+5F)
50-60 yrs	10(5M+5F)
60-70 yrs	10(5M+5F)
70-80 yrs	10(5M+5F)
80yrs+	10(5M+5F)

Table-2: Distribution of the subjects.

B) Instruments

A Compaq 2374 model laptop, U. S. blaster stereo dynamic headphone HP-75, DMDX and Cognispeed software were used.[1]

C) Procedure

Stage I

Baseline assessment: All the subjects were assessed on vigilance subtest of Cognispeed to ensure adequate attention. Task was identification of alphabet "A, T & P" which was well inserted across other alphabets. Subjects replied by pressing space bar key as early as possible. Criteria was set as 30% target letters, presentation time 3500msec, maximum time interval and minimum time interval 1000msec each. The duration of the test was scheduled for 15 minutes. Average recognition frequency is the number of correct responses out of total stimuli presented (accuracy). It was automatically calculated by the software for the whole test and was considered as the characteristic parameter.

[1] DMDX is a Win 32-based display system used in psychological laboratories around the world to measure reaction times to visual and auditory stimuli. It was developed and programmed by Jonathan Forster & Kennath Forster at the University of Arizona. http://www.u.arizona.edu/~-kforster/dmdx/dmdx.htm

2 CogniSpeed is an easy-to-use test program for measuring the speed and accuracy of human information processing. (Produced and distributed by Aboa Tech Ltd, University of Turku, Finland).

Stage II

Development of test stimuli: 10 categories of nouns with each set of five pictures in a series having four pictures from one lexical category (Regular item) and one picture from a different lexical category (Inserted item) were chosen. It was hypothesized that there is high cognitive-linguistic demand to perform inter lexical category shifting task because it has to counterbalance the category clue effect. Time taken (reaction time) by the subjects to shift from one lexical category to the other lexical category was measured and compared across lexical shifting within category.

A total of 50 pictures were chosen for the study. Position of inserted lexicons was randomized across regular lexicons. The pictures were selected from 'With a little bit of help...Early Language Training Aids' in which the pictures have already been subjected to field test (Karanth, Manjula, Geetha and Prema, 1998).

Stage III

Programming the stimuli: DMDX is a member of the DMASTR family, and it represents an extension of the original DOS programs (DM and DMTG) to a Windows 95/98 environment will be programmed according to the test stimuli. It was developed by University of Arizona. It is a run-time environmental experimental stimulus for gathering response. Its strength lies in its precise control. It is appropriate for perceptual experiments (auditory, visual) where very accurate timing is required. Computer based coding system is used for observational data recording. It provides researcher a reliable and accurate way of coding observational data.

Stimuli were programmed using DMDX software. Stimulus presentation time (time duration for which stimulus was displaced on the monitor) was fixed for

3500millisecond (ms) and the inter stimulus gap (time taken between disappearance of one picture to appearance of the following picture) was fixed for 1500ms. With the help of DMDX, series of pictures were randomized for each trial, however keeping the sets of five pictures constant.

A pilot study was done on 5 elderly subjects. Results suggest that with increased presentation time (3500ms) the error response was reduced up to 12% of the total responses. It helped in getting the increased percentage (88%) of valid responses.

Stage IV

Administration: Series of pictures were shown on the computer screen. Subjects were instructed to name the picture as early as possible in their native language. The verbal responses were recorded with the help of a microphone connected to the computer. Software was programmed so that it can be paused any time by pressing space bar key manually for ease of administration on the geriatric population. DMDX software measures the reaction time between the presentation of stimulus and onset of the response.

D) Test environment

Testing was performed in silent room with minimal background noise. To increase the sensitivity of the test DMDX software has the facility which helps in varying background noises. Subjects were instructed to sit 60cm away from the computer monitor.

E) Task

Inter lexical category shifting task was chosen i.e, Out of 5 stimuli one of the stimulus was from different lexical category (inserted item). Eg: /spoon, glass, plate, knife, **rose/** (see Appendix). It was hypothesized that there is high cognitive-linguistic demand to

perform inter lexical category shifting task because it has to counterbalance the category clue effect. Time taken (reaction time) by the subjects to shift from one lexical category to the other lexical category was measured and compared across lexical shifting within category.

F) Response

Verbal mode of response was selected and programmed using DMDX software. First utterance from the speaker was considered as appearance of target response. So, reaction time is the time duration between stimulus presentations to appearance of first verbal output. Reaction time in millisecond was automatically recorded in Microsoft excel by the software. Further data was analyzed using SPSS 15 version software.

Chapter IV

RESULTS AND DISCUSSION

The results of vigilance and cognitive-linguistic tasks were analyzed to evaluate the objectives of the study. Vigilance score was one of the criteria to include the subject for this study. The data was collected separately for vigilance task and for naming task of the stimuli. The data was analyzed

a.) To know vigilance score across age group.

b.) To assess the cognitive-linguistic flexibility across age groups.

c.) To enumerate reaction time of target stimuli across age groups,

d.) To find out cognitive-linguistic interference.

A. Baseline Measure: Vigilance Task of Cognispeed

The concept of vigilance refers to a human observer's state of alertness in tasks that demand efficient registration and processing of signals. The main characteristics of vigilance tasks are relatively long durations and the requirement to detect infrequent and unpredictable target stimuli (signals) against a background of other stimulus events. Another aspect of the study was to assess the vigilance score as age increases. Vigilance task of Cognispeed was selected for subjects to asses how vigilant they are and to know is there any deterioration in vigilance ability as age increases? The additional objective was to find out the vigilance score across each decade of age group and to develop a normative on Indian population.

Age Group	Vigilance Score (%)
30-40	**79**
40-50	**78**
50-60	**75**
60-70	**46.5**
70-80	**41.8**
80+	**22**

Table 3: Average recognition frequency (accuracy in %) across age group.

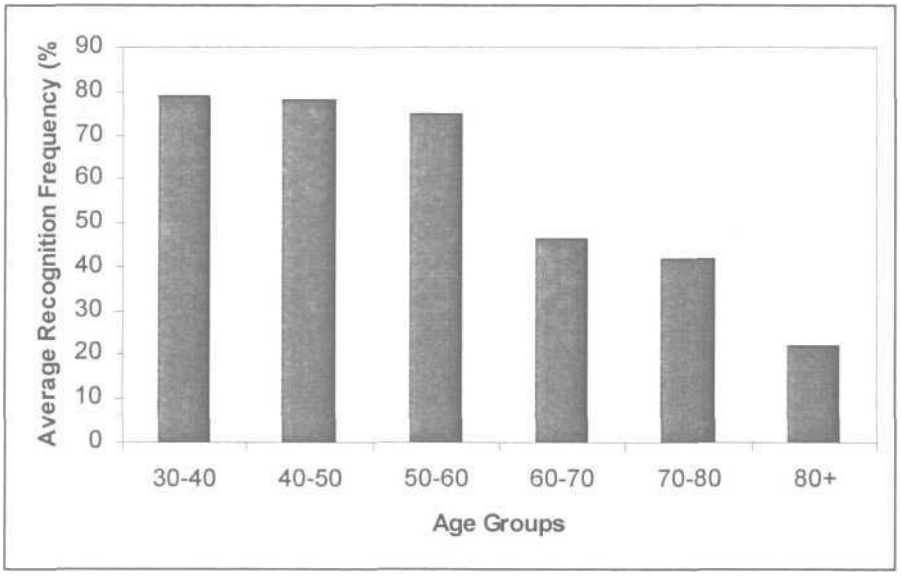

Figure 1: Average recognition frequency (accuracy in %) across age group.

Average recognition frequency (that is the overall average accurate response for entire 15 minutes task duration) in percentage was measured for each age group. Figure 1 clearly indicates that there is a significant ($p<0.01$) reduction in the vigilance score as age advances. Hence the total number of subjects were 60 i.e., 10 (5M + 5F) for each age group so, the score of each age group can be considered as normative values for Indian population. Language independence of this test strengthens its generalization aspects.

A sudden decline in accuracy was observed immediately after sixty years of age. So, further sub grouping was done to identify the significant reduction in vigilance skills into two age groups i.e., 30-60 and 60-80+.

Age Group	**Vigilance Score** (%)
30-60	76.33
60-80+	37.77

Table 4: Average recognition frequency (accuracy in %) across two sub groups.

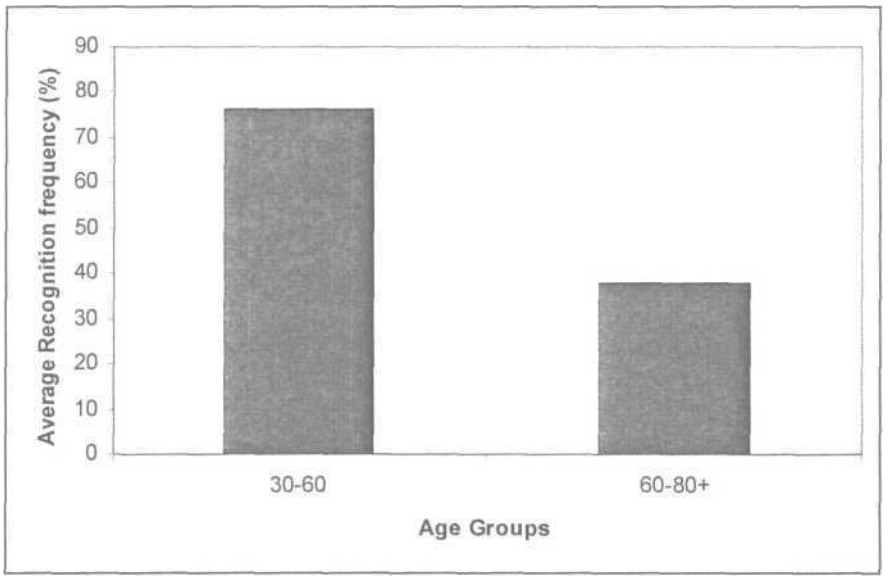

Figure 2: Average recognition frequency (accuracy in %) across two sub groups.

A sharp decline was observed in the recognition accuracy after 60 years. So, further sub grouping was done in the age group between less than 60 and more than 60 i.e., 30-60 and 60-80+. Average vigilance score of age group 30-60 and 60-80+ was compared. Again, a statistically significant ($p<0.01$) difference was found.

B. Cognitive-Linguistic Flexibility across Age Group

It can be inferred from the Table 5 and Figure 3 that there is no significant deterioration in cognitive-linguistic flexibility as age advances. Task was chosen to measure reaction time differences for regular and inserted items across all age groups. In this study no significant difference was found between the reaction time of regular items and inserted items.

Age Group	Regular Items (RT)	Inserted Items (RT)
30-40	1083.27	1020.85
40-50	1187.82	1034.25
50-60	1376.05	1307.73
60-70	1640.00	1697.34
70-80	1759.17	1711.48
80+	1755.60	1780.49

Table 5: Mean Reaction Time (ms) of Regular and Inserted items across age group.

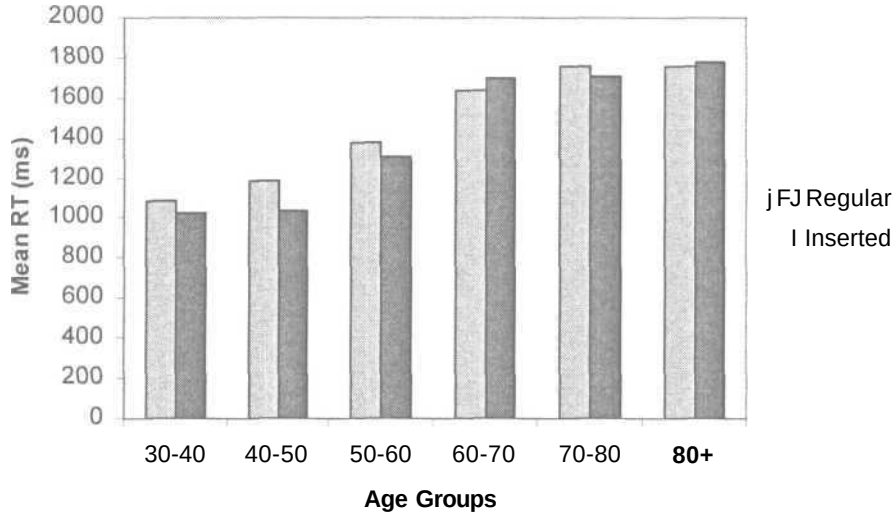

Figure 3: Mean Reaction Time (ms) of Regular and Inserted items across age group.

After sub grouping the subjects in two major groups i.e. 30-60 and 60-80+, as shown in the Table-6 & Figure-4 below, there is slight difference in the reaction

time of regular items and inserted items for 30-60 age groups but this difference was not statistically significant.

Age Group	Regular Item RT	Inserted Item RT
30-60	1215.71	1120.94
60-80+	1718.26	1729.77

Table 6: Mean Reaction Time (ms) of Regular and Inserted items across two sub groups.

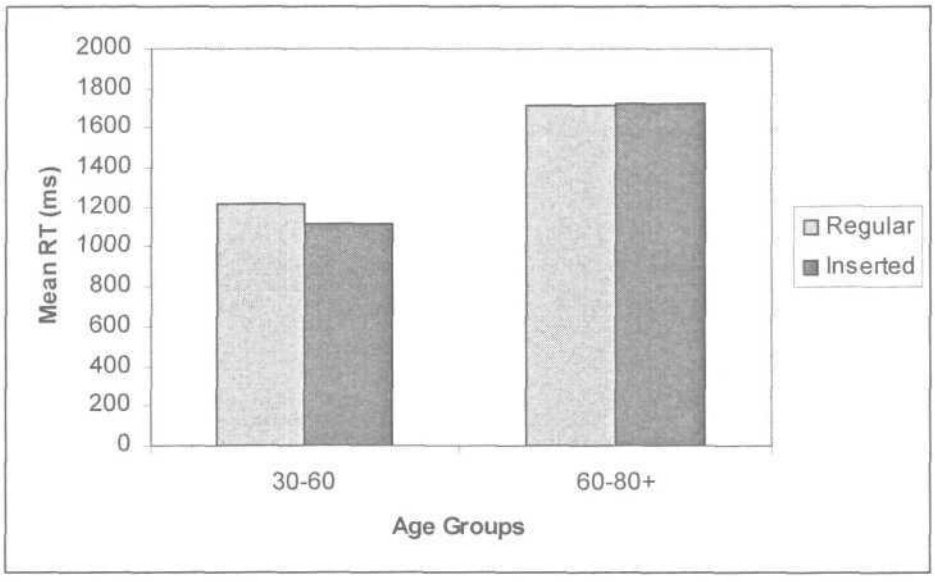

Figure 4: Mean Reaction Time (ms) of Regular and Inserted items across two sub groups.

Rogers, (1986) reported the apparent slowing of cognitive processes in advancing age. Slowing of peripheral and central component of reaction time and processing speed could be demonstrated to be present even at the age 50 to 55 (Eriksen, Hamlin, & Daye, 1973). Using this, slowing of cognitive processes has been found to occur in normal elderly (Mayeux, Stern, Sano, Cote, & Williams, 1987).

This study also suggests that there is slowness in the cognitive processing as it can be inferred from the increase in the overall response time across two major age group (30-60 Vs 60-80+). The selected tasks assessed the cognitive-linguistic flexibility i.e., the ability to shift cognitive set, aptitude, thought, or attention in order to perceive, process or respond to situations in different ways (Eslinger and Graten, 1993). This shifting occurs when either external task conditions or self initiated decision require that an alternative to the current response be chosen and executed (Richards, 1993). In the present study there were four lexicons from one category while one was inserted in that set randomly from different lexical category. Task was to name the pictures verbally as early as possible in subject's most comfortable language. Aim of the study was to find out if there is any significant deterioration in cognitive-linguistic flexibility by assessing the difference in reaction time of regular item Vs inserted item.

An alternate possibility for absence of significant difference can be the fact that the time limit which was fixed for 3500ms i.e., any verbal response (utterance) if it was within 3500ms software recorder it as valid response, was too long. Subjects used to get enough time to find the exact name of the target stimulus. Predominantly in geriatric population subjects corrected the target stimulus even after repeated incidence of paraphasia or circumlocution; it can be well cited by analyzing the recorded audio responses. So, to assess the cognitive linguistic flexibility with such stimuli and design, there should be short and fixed time limit within which subject has to response.

Recorded audio responses of stimulus reveal that more than 50% of the responses were in other than primary language i.e., in secondary or tertiary language. Majority of the subjects were bilingual/multilingual. In qualitative analysis of the recorded audio responses it was observed that for a number of stimuli subjects responded first in second/third language immediately followed by primary language response. It can be explained in two ways, Is bilingualism facilitating more competing words during target word retrieval? i.e., is target word in primary language competes with target word in secondary/tertiary language and is it a strong variable during naming task? Or does bilingualism provide more flexibility in naming task i.e., name in primary or secondary language whatever is retrieved first? Both incidences were observed during this study. In younger elderly population lexicons in different languages served as competing words. Even after instructing that response in native language for equal familiar items, subjects responded in secondary and tertiary languages. While in case of geriatric population they used secondary language responses when they were not able to get the target word in primary language. So, it can be concluded that bilingualism is one of the strong variables during such studies. It can be also be concluded that the bilingual/multilingual are probably more cognitively-linguistically flexible than monolingual.

Given the inextricable link between cognition and language, it is not surprising that age-related cognitive changes are implemented as a causative factor in reduced linguistic processing abilities. It is remarkable, however, the extent language and aging literature focuses almost exclusively on diminished abilities, without

consideration of preserved abilities and more importantly, ways to enhance those abilities (Kemper, 1992). To gain a more complete understanding of text processing in aging, other variables known to influence understanding of written language (e.g., text genre, cognitive processing requirement, comprehension-enhancing strategies) must be empirically tested to assess their influences on performance.

C. Mean Reaction Time across Age Groups

The second aim of the study was to find out the relationship between reaction time and aging. The responses were recorded by the DMDX software automatically and accurately in millisecond values in Microsoft excel for picture naming task of the selected stimuli. Reaction time was defined as the time duration between stimulus appearances to onset of response. Stored data was arranged across age groups i.e., every age group containing 10 subjects (5M + 5F). Mean reaction time value for all the age groups was noted.

Age Group	**Mean RT** (ms)
30-40	1069.82
40-50	1157.99
50-60	1361.52
60-70	1651.60
70-80	1749.60
80+	1760.52

Table 7: Mean Reaction Time (ms) across age groups.

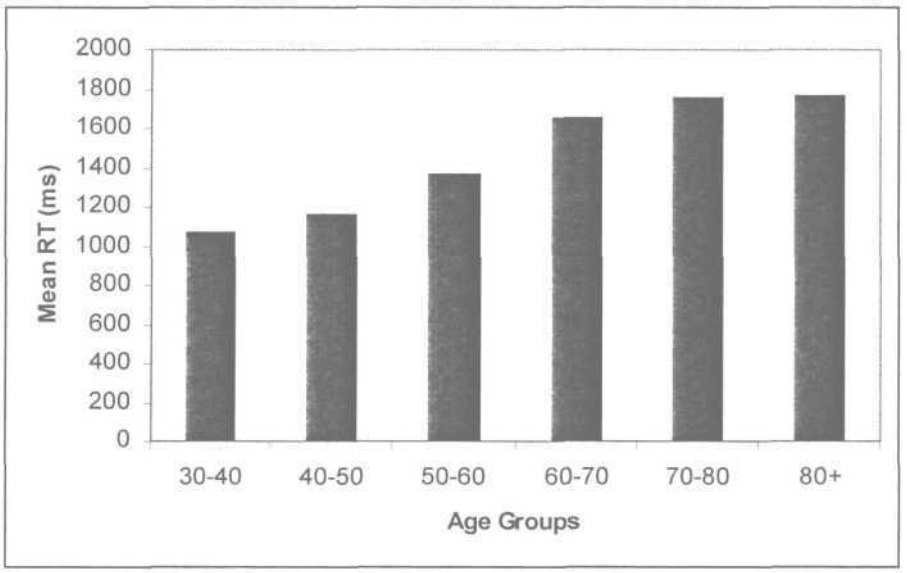

Figure 5: Mean Reaction Time (ms) across age groups.

Table 7 and Figure 5 indicate that there is an increase in the mean reaction time as age advances. It means that as age advances time taken for retrieving a word increases. Reduced speed of information processing is characteristic among older subjects. Speed of information processing serves as a behavioral indicator for reduced processing capacity associated with aging. Researchers infer that self-paced reading time, or retrieval duration, is the behavioral manifestation of active cognitive processing (Frederiksen et. al., 1990). In a study of working memory and cognitive monitoring effects of text recall, Zabrucky and Moore (1994) found a significant age effect of reading time, with older adults taking longer than younger adults to read experimental texts. Similar finding is observed in this study. Irrespective of text here the task was picture naming which are supposed to be easier and better than the text. But result suggests that there is overall increase in reaction time across increasing age group. It can be concluded based on above discussion that there is significant effect of aging on retrieval of lexicon irrespective of its mode of presentation (text, verbal or picture).

Borod, Goodglass, & Kaplan (1980) administered Boston Naming Test to normal young and elderly adults. They found that subjects over 70 years of age named significantly fewer items than younger subjects. Nicholas, Oblar, Albert, and Goodglass (1995) reported similar results for the naming of action pictures. Albert et al. (1988) and Nicholas et al. (1985) concluded that picture naming difficulties became apparent only when the subjects in their study reached 70 years old. They found that the subjects aged between 70 to 79 years old named significantly fewer pictures than those of younger decades (60s, 50s, 40s, and 30s) ,

but no other significant decline was founded between any two other consecutive age decades. Results reported by Thuillard and Assal (1989) are consistent with this finding in that picture naming scores were stable before age 70 but abruptly decreased after 70 years old. Similarly, adults in their 30s named significantly more items than subjects 70 to 79 years of age in Bowels et al. (1987). These two decades were the only ages considered in this study. In the same vein, Van Grop et al. (1986) pointed out that mean scores of subjects aged between 59 and 69 years were commensurate with norms of the 60-items version of the Boston Naming Test provided (Kaplan et al., 1983) for younger individuals, whereas scores for the subjects in their 70s and older were consistently lower.

In this study a significant ($p<0.01$) decline in retrieval ability has been observed but that critical age identified in this study is 60 years onwards compared to 70 years of above quoted studies. This finding also justifies the need of this study. There are a number anatomical, physiological, psychological, socio-cultural and educational differences between Indian population compared to Western population. These factors influence cognitive and linguistic abilities. Comparing both studies we may conclude like that there are some variables (communication demand, post-retirement life style, physical and communicational intactness etc.) would have probably influenced for early aging compared to western population.

Goodglass (1995) found that in the absence any phonological information, older subjects had more difficulty in spontaneously retrieving the target word than did younger subjects. In this study also paraphasia and circumlocution was observed

predominantly in females in 70+ age groups. This suggests that there was target word finding difficulty in the absence of any type of cues.

Considerable evidences exist to suggest that naming ability decline with advancing age. One common complaint of elderly people is increased difficulty in finding words in every day speaking and writing. The ability to access vocabulary appears to decrease with increasing age (Bowels & Poons, 1985). Furthermore, some evidences suggest that object naming, naming latency, and word fluency declines with age (Obler & Albert, 1981). Some discrepancy in the literature exists in characterization of naming abilities in elderly subjects, probably as consequences of the nature of the task accessing lexicon. While incongruity exists in characterization of naming ability in the elderly with advancing age, the difficulty in lexical access appears to be real.

In spite of the above mentioned studies along with this study it can be finally concluded that cognitive aging is a natural phenomenon. Given the inextricable link between cognition and language, it is not surprising that age-related cognitive changes are considered as a causative factor in reduced linguistic processing abilities. There is a general agreement across various studies that processing speed or cognitive functioning slows as age advances.

Age Group	Mean RT (ms)
30-60	1198.44
60-80+	1720.57

Table 8: Mean Reaction Time (ms) across two sub groups.

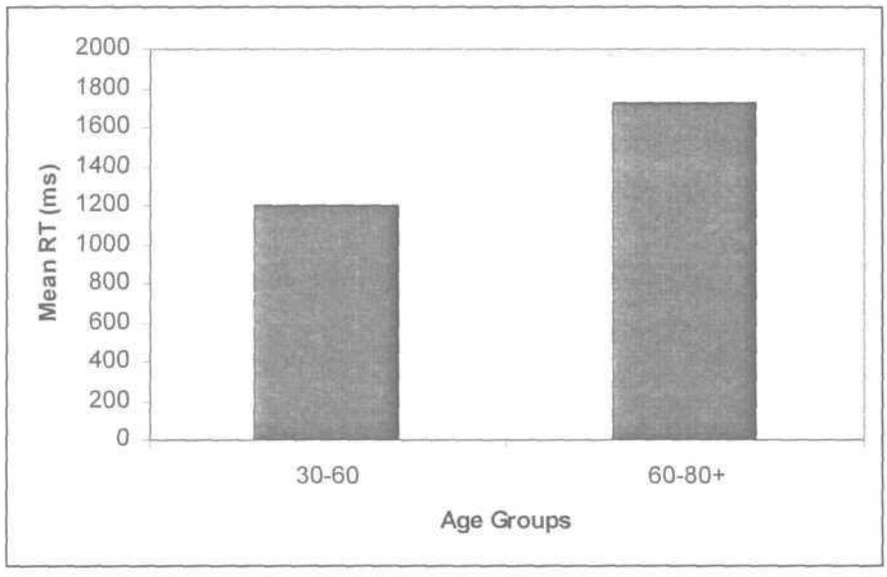

Figure 6: Mean Reaction Time (ms) across two sub groups.

The reaction time was compared by classifying the subjects into two major groups i.e., 30-60 and 60-80+. A high significant difference ($p<0.01$) was observed between the two age groups.

D. Relationship between Vigilance and Aging

There was an additional aim to find out relationship between vigilance score and reaction time for retrieval of the target lexicon. Kempler, Van Lanker, and Read (1988) attempted to separate language and cognition in their study on proverb and idiom interpretation. This study was also designed to compare cognitive linguistic parameters and to find out is there interaction between the two.

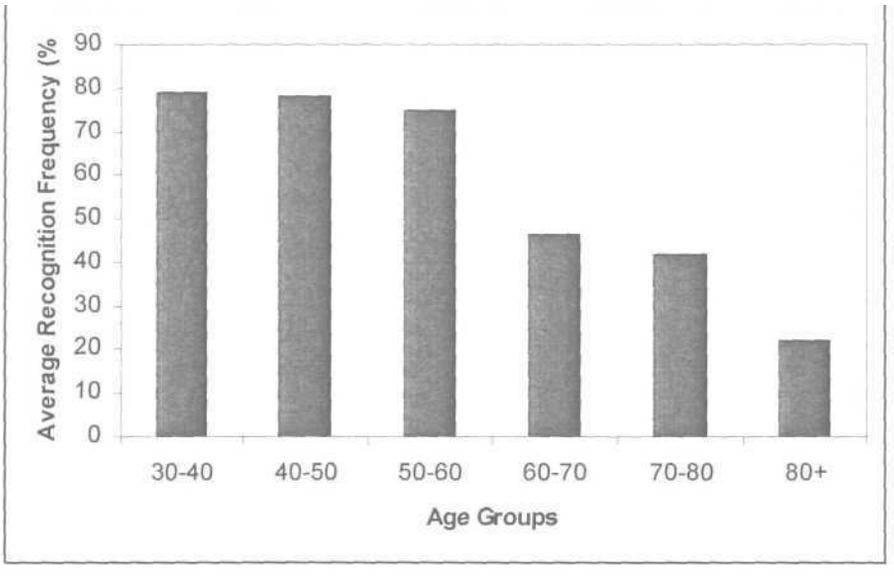

Figure 7: Average recognition frequency (accuracy in %) across age group.

Vigilance task of Cognispeed was chosen to assess the ability to maintain attention for fixed time (15 min) duration. Average recognition frequency which is the percentage accurate response was calculated for all age group. Reaction time for retrieval of target response for the designed stimuli was measured. Here the response was in millisecond unit. Hence both the parameters were in two different units. Pearson correlation was used to find out is there any significant relationship between the two scores.

Age **Group**	**Vigilance Score (%)**	**Mean RT (ms)**
30-40	79	1069.82
40-50	78	1157.99
50-60	75	1361.52
60-70	46.5	1651.60
70-80	41.8	1749.60
80+	22	1760.52

Table 9: Vigilance score (%) and Mean Reaction Time (ms) across age groups.

A strong negative correlation (r = -0.98) value was found between average recognition frequency and reaction time. It suggests that as age increases (30-80) vigilance score reduces (79%-22% accuracy) and the reaction time for retrieval of target response increases (1069.82ms-1760.52ms). From this finding it can be inferred that as age advances both cognitive and linguistic parameters reduces. So there are some sorts of interaction between cognitive and linguistic abilities.

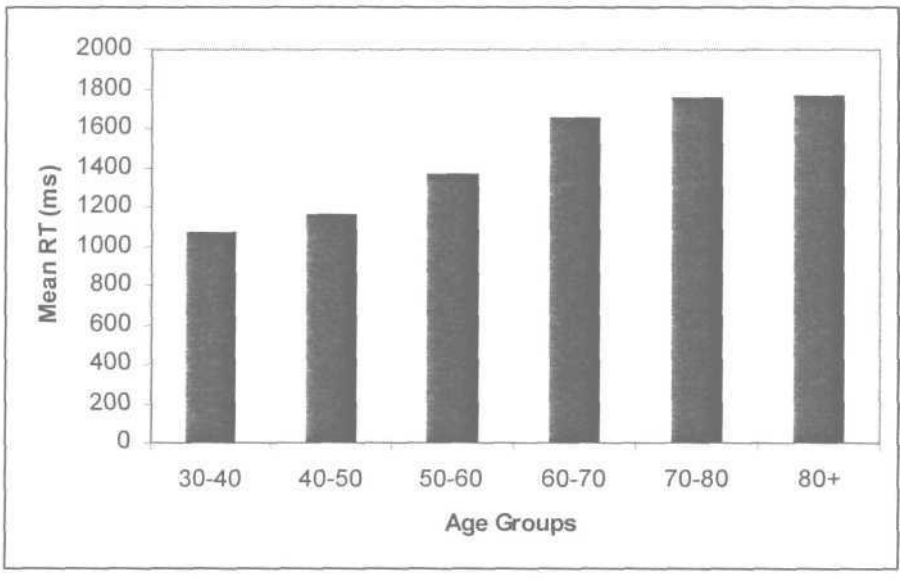

Figure 8: Mean Reaction Time (ms) across age groups.

E. Vigilance Score Vs Mean RT of Two Major Subgroups

Subject's age group was subdivided into two major age group ie 30-60 and 60-80+ well justified by the fact that 60 onwards a major change was observed and larger subject number will strengthen the generalization aspect of this study.

Same pattern of relationship ($p<0.01$) was observed between average recognition frequency and reaction time of retrieval for target stimuli was observed with stronger correlation co-efficient vales (r = approx -1).

Age Group	**Vigilance Score** (%)	**Mean RT (ms)**
30-60	76.33	1198.44
60-80+	37.77	1720.57

Table 10: Vigilance score (%) and Mean Reaction Time (ms) across two sub groups.

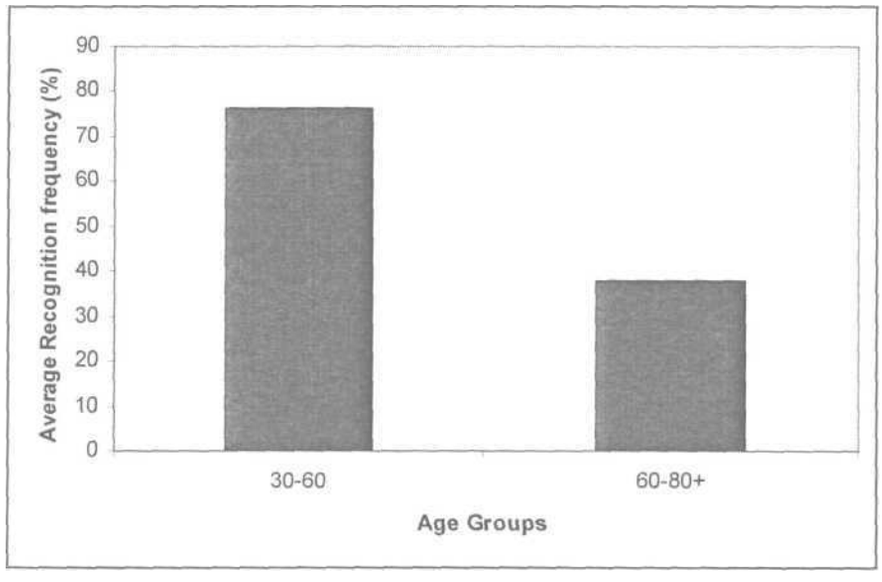

Figure 9: Vigilance score (%) across sub

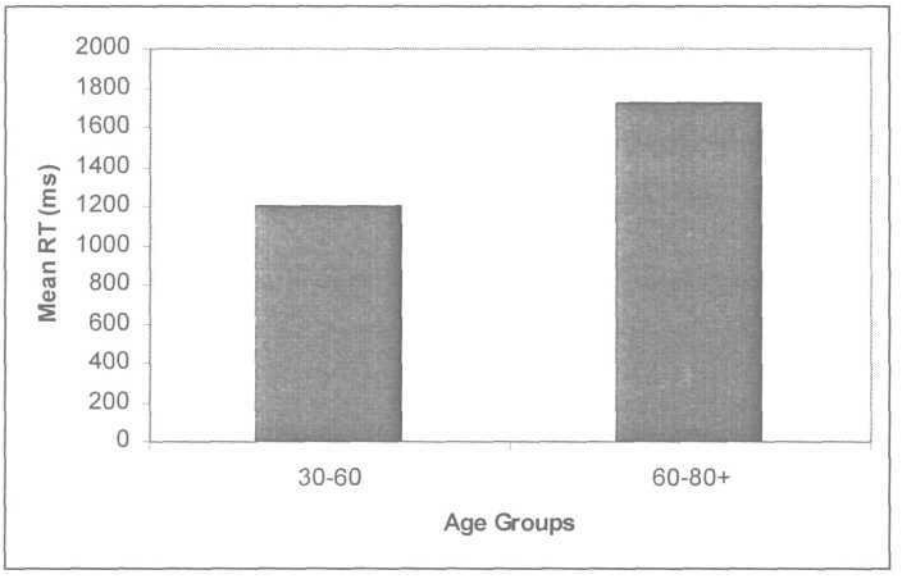

Figure 10: Mean Reaction Time (ms) across two major age groups.

All the subjects were assessed on vigilance task of cognispeed. A gradual reduction was observed with increase in age. Even highest age group (80+) subjects were facilitated with 22% response accuracy which suggests that they were vigilant enough to be included for this study. Mean reaction time for regular and inserted items showed no significant decay with advancement in age suggests that there are some variables which delay onset of cognitive rigidity. Gradual increment in mean reaction time across age groups for picture naming of selected stimuli indicates that there is significant effect of aging on picture naming task. The scores on vigilance task and the mean reaction time shows an inverse relationship i.e., as vigilance score reduces the mean reaction time for naming increases.

The results of the present study indicate that although there is a decrease in vigilance and an increase in the mean reaction time for naming, the accuracy for naming was not impaired in the 60-80+ sub group of subjects. Further, it was also observed that a significant difference in reaction time was obtained from 60 years

onwards, whereas in the western literature it is reported to manifest from 70 years onwards. This trend for earlier onset of cognitive slowing in Indian population may be attributed to difference in lingualism (bilingualism/multilingualism), life style, culture, profession, physical and communicational activity, post retirement life activity, education. These results have much significance for prevention of age related communication disorder in Indian contexts.

Chapter V

SUMMARY AND CONCLUSIONS

Aging is the process of becoming older, a process that is genetically determined and environmentally modulated. Normal aging often refers to the most common or usually encountered functional state of the nervous system in a population of older individuals (Whitehouse, 1991). In addition to the physical changes, normal aging is also accompanied by changes in the ability to process, understand and use language. Although, there is no global decline in linguistic functions, decline in certain cognitive functions like attention, memory, recall with increasing age has been reported. A general decline in reaction time has also been documented. These cognitive changes impinge on linguistic abilities leading to difficulties in word retrieval process (Kemper; 1992; Maxim, 1999); decline in complex discourse processes (Ulatowastia, 1985); slight diminution in language performance in terms of use of semantic information, structures, error of reference, intact phonological and grammatical systems within the clauses; but reduction in type of clauses structure and verb phrases used.

Aging is associated with special physical, emotional and social burdens imposed by mental decay in later life and a general wear and tear at anatomical and functional levels. Based on these aging can be divided into following types. *Biological aging* as Handler's (1960) defined "Aging is a deterioration of a mature organism resulting from time dependent, essential irreversible changes intrinsic to all members of the species such that, with the passage time, they become increasingly unable to cope with the stresses of the environment, thereby increasing the

probability of death. *Psychological Aging;* Birren and Renner (1980) have defined psychological aging as "the regular changes that occur in mature, genetically represented organism living under representative environmental conditions as they advance in chronological age. *Social Aging* is the process of adapting the age roles assigned by society. It refers to process of adjustment to societal norms. *Cognitive Aging* is the cognitive changes related with aging are central to theoretical explanation of observed language processing deficits, with production deficiency and reduced processing capacity as the prevailing explanations for such changes (Bayles & Kasnik, 1987; Cohan & Faulkener, 1981).

Cognitive flexibility commonly refers to the ability to shift cognitive set, aptitude, thought, or attention in order to perceive, process or respond to situations in different ways (Eslinger and Graten, 1993). This shifting occur when either external task conditions or self initiated decision require that an alternative to the current response be chosen and executed (Richards, 1993). The nature of cognitive linguistic flexibility is rarely defined beyond general statement about the ability to shift cognitive linguistic set. Eslinger and Grattan (1993) emphasized a collective cognitive processes contributing to flexible cognitive behavior, such as producing diverse idea, considering response alternatives, and modifying plans and behavior in order to manage changing circumstances and long term goals. Such a characterization of cognitive flexibility connects it to real-life situations and highlights the potentially pervasive functional difficulties in persons with impaired flexibility.

An area that speech language clinician should consider during assessment of persons with impaired flexibility is the form of cognitive linguistic flexibility as per the situational demands. Cognitive linguistic flexibility has been dichotomized into reactive flexibility and spontaneous flexibility. Reactive flexibility is the ability to free shift cognition or behavior in response changing tasks or situational demands. Different tasks and situations require different type of reactive shifts and, presumably, different underlying cognitive processes. Spontaneous flexibility represents the ability to produce diverse ideas, consider response alternatives, and modify plans.

The number of geriatric is expected to increase four fold rise by the year 2025. This trend is true and representative not just of the Indian population but also the world's population (in millions). Communication being one of the prime requirements for successful living, a Speech-language Pathologist would become a key professional to preserve this skill in the aging population. In the absence of such studies on Indian population, the present study is designed to examine the cognitive linguistic flexibility across different age groups and the relationship between aging and reaction time for picture naming.

Sixty (30M+30F) healthy growing individuals of the age group 30 to 80+ with no history of neurological or psychological complain were selected for the study. 10 categories of nouns with each set of five pictures in a series having four pictures from one lexical category (Regular item) and one picture from a different lexical category (Inserted item) were chosen from 'With a little bit of help...Early Language Training Aids' (Karanth, 1998). Stimuli were programmed using DMDX

software. Stimulus presentation time was fixed for 3500ms and the inter stimulus gap was fixed for 1500ms. Stimuli were randomized for each trial, however keeping the sets of five pictures constant. A Compaq 2374 model laptop, U. S. blaster stereo dynamic headphone HP-75, DMDX and Cognispeed software were used during this study. Subjects were instructed to name the pictures as early as possible in their common spoken language. Reponses were recorder for each individual stimulus by the software.

The main aim of the study was to check for cognitive-linguistic flexibility across age. As result indicates no statistically reliable correlation was obtained between regular and inserted items. It further explains that there is no significant deterioration in cognitive-linguistic flexibility as age advances. It means even in advancing age there are some extraneous variables which prevents cognitive rigidity. Some of these variables can be identified as linguistic exposure i.e., bilingualism (bilingualism/multilingualism), life style, culture, profession, physical and communicational activity, post retirement life activity, education, social/familiar roles, communication intent, physical and mental exercises and dietary habits. Subjects used to get enough time to find the exact name of the target stimulus. Recorded audio responses of stimulus reveal that more than 50% of the responses were in other than primary language i.e., in secondary (L2) or tertiary language (L3). Majority of the subjects were bilingual/multilingual.

The second aim of the study was to find out if there is overall increase in reaction time for retrieval of target word as age advances. It was found that there is a significant increase in the mean reaction time for retrieval of target word as age

advances. It means that as age advances time taken for retrieving a word increases. These are the effects of cognitive-linguistic processing slowness with advancing age. The critical identified in this study for onset of cognitive aging is 60 years onwards compared to 70 years of in review quoted by some of the western studies. There are a number anatomical, physiological, psychological, socio-cultural and educational differences between Indian populations and Western population. These factors also influence cognitive and linguistic abilities. Given the inextricable link between cognition and language, it is not surprising that age-related cognitive changes are considered as a causative factor in reduced linguistic processing abilities. Various studies having varying design and task commonly agree that processing speed or cognitive functioning become slow with increasing age.

The concept of vigilance refers to a human observer's state of alertness in tasks that demand efficient registration and processing of signals. Vigilance task of Cognispeed was selected for subjects to asses their vigilance ability with increasing age. Result clearly indicates that there is significant reduction in the vigilance score as age advances. A sharp decline was observed in the graph after 60 years. So, further sub grouping was done in age group between less than 60 and more than 60 i.e., 30-60 and 60-80+. Average vigilance score of age group 30-60 and 60-80+ was compared. Here also a statistically significant difference was observed.

In conclusion, this study suggests that there is no Cognitive-Linguistic Flexibility reduction as age advances. Although there are evidences of overall cognitive and linguistic performance slowness at various levels but still Cognitive-Linguistic skills remains intact. Older subjects have greater difficulites in target word

retrieval and in vigilance task performance. In site of this study along with similar study in western population as mentioned in the review it can be finally said that cognitive aging is a natural phenomenon. Comparing both studies (this study and similar western studies) it can be concluded that there are some variables (communication demand, post-retirement life style, physical and communicational intactness etc.) which are influencing Indian Population for early aging compared to western population.

As result indicates no statistically reliable correlation was obtained between regular and inserted items. It further explains that there is no significant deterioration in cognitive-linguistic flexibility as age advances. It means even in advancing age there are some extraneous variables which avoids cognitive rigidity. Some of these variables can be identified as linguistic exposure i.e., lingualism (bilingualism/multilingualism), life style, culture, profession, physical and communicational activity, post retirement life activity, education, social/familiar roles, communication intent, physical and mental exercises and dietary habits. These results have much significance for prevention of age related communication disorder in Indian contexts.

Limitations of the study

1. Stimulus presentation (regular & inserted items) was not so efficient to measure the cognitive-linguistic flexibility. Better selection of the task would have been provided significant result.
2. To assess Cognitive-Linguistic flexibility higher level of task ought to be chosen rather than picture naming task.

3. The scenario of bilingualism/multilingualism in India makes it difficult to isolate the contribution of the linguistic variables to cognitive-linguistic tasks.

Implications of the study

1. This study can be used to find out at what age cognitive aging starts and what measures can be done to delay cognitive rigidity.
2. Vigilance score can be used as normative for Indian population.
3. The result of the study can be useful while making geriatric communication prevention programs.

Future Directions

1. A study design having able enough to assess both reactive and spontaneous Cognitive-Linguistic flexibility can be done.
2. Cognitive-Linguistic function, interaction, deterioration can be assessed at every higher level of language function.
3. Cognitive-Linguistic flexibility deterioration on clinical population such as Dementia, Neurological insult, Alzheimer's can be done.
4. A comparative study between non-brain damaged populations, brain damaged Population and normal aging on cognitive and linguistic aspects can be done.

REFERENCES

Albert, M., Duffy, F.H., & Naeser, M. (1987). Nonlinear changes in cognition with age and their neuropsychological correlates. *Canadian Journal of Psychology, 41,* 141-157.

Albert, M. S., Heller, H. S. & Milberg, W. (1988). Changing in naming ability with age. *Psychology and Aging, 3,* 173-178.

Ardila, A., & Rosselll, M. (1989). Neuropsychological characteristics of normal aging. *Developmental Neuropsychology, 5,* 307-320.

Au, R., Obler, L. K., Joung, P. C. & Albert, M. L. (1990). Naming in normal aging: Age-related differences or age-related changes? *Journal of Clinical and Experimental Neuropsychology, 12,* 30-38.

Bachy-Langedock, N. (1988). ExaDe: Batterie d'examen des troubles en denomination, Bruxelles: Editest.

Bayles, K. A., & Kasnain, A. W. (1987). Communication and cognition in normal aging and dementia. Boston: College-Hill Press.

Bayles, K., & Kaszniak, A. (1987). Communication and cognition in normal aging and dementia. *Aphasiology, 2,* 161 -173.

Bayles, K., & Tomoeda, C. (1983). Confrontation naming in dementia. *Brain and Language, 19,98-114.*

Bayles, K. A., Trosset, M. W., Tomodea, C. L., Montgomery, E. B., & Wilson, J. (1993). Generative naming in Parkinson disease patient. *Journal of Clinical and Experimental Neuropsychology, 15,* 547-562.

Beasley, D. S., & Davis, G. A., (1981). Aging communication processes and disorders. Grune & Stratton, Inc., New York.

Beland, R., & Lecours, A. R. (1990). The MT-86 B Aphasia Battery-A subset of normative data in relation to age and level of school educatioa *Aphasiology, 4,* 439-462.

Bergman, M. (1971). Hearing and aging. *Audiology, 10,* 164-171.

Bess, F. H., Lichtenstein, M. J., Logan, S. A., & Burger, M. C. (1989). Comparing criteria of hearing impairment in the elderly: A functional approach. *Journal of Speech and Hearing Research, 32,* 795-802.

Birren, J. E. & Renner, V. J. (1980). Concepts and issues of mental health and aging. In J. E. Birren & R. B. Sloane (Eds.), *Handbook of mental health and aging.* Englewood cliffs, NJ: Prentice-Hall.

Borod, J., Goodglass, H., & Kaplan, E. (1980). Normal data on the Bostan Diagnostic Aphasia Examination, Parietal Lobe Battery, and the Bostan Naming Test. *Journal of Clinical Neuropsychology, 2,* 209-215.

Botwinick, J., & Storandt, M. (1974). Vocabularies ability in later life. *Journal of Genetic Psychology, 125,* 303-308.

Bowles, N., Obler, L. K., Albert, M., & Nicholas, M. (1985). Naming impairment in the elderly. Paper presented at the annual meeting of the Academy of Aphasia, Pittsburgh, PA.

Bowles, N., Obler, L. K., Albert, M. (1987). Naming errors in healthy aging and dementia of the Alzheimer type. *Cortex, 23,* 519-524.

Bowles, N. L., & Poon, L. W. (1985). Aging and retrieval of words in semantic memory. *Journal of Gerontology, 40,* 71-77.

Burke, D. M., Worthley, J., & Martin, J. (1988). I'll never forget what's-her-name: Aging and tip of the tongue experience in everyday life. In M. M. Gruenberg, P. E. Morris, & R. N. Sykes (Eds.), *Practical aspects of memory* (Vol. *2,* pp. 113-118). New York: Wiley.

Cabeza, R. (2002). Hemispheric asymmetric reduction in older subjects: The HAROLD model. *Psychology and Aging, 17,* 85-100.

Carr, T. H., McCauley, C, Sperber, R. D., & Parmelee, C. M. (1982). Words, pictures, and priming: On semantic activation, conscious identification, and the automaticity of information processing. *Journal of experimental Psychology: Human Perception and Performance,* 8, 757-777'.

Causino, M., Obler, L. K., Knoefel, J., & Albert, M. (1990). Pragmatic abilities in late-stage SDAT. Manuscript submitted for publication.

Ceccaldi, M., & Joanette, Y., (1996). The effect of age induced changes in communication abilities on the type of aphasia *Brain and Language, 54,* 75-85.

Censtantinidou, F., & Baker, S., (2002). Stimulus modality and verbal learning performance in normal aging. *Brain and Language, 82,* 296-311.

Chapey, R. (1995). Cognitive intervention: Stimulation of cognition, memory, convergent thinking, and evaluative thinking. In Chapey, R. (Ed.) *Language intervention strategies in adult aphasia* (pp. 220-245). Baltimore: William & Wilkins.

Chapey, R., Rigrodesky, S., & Morrison, E. M. (1977). Aphasia: A divergent semantic interpretation. *Journal of Speech and Hearing Disorders, 42,* 287-295.

Clark, E. O. (1980). Semantic and episodic memory impairment in normal and cognitively impaired elderly adults. In L. K. Obler and M. L. Albert (Eds.), *Language and communication in the elderly* (pp. 47-57). Toronto: Lexington Books.

Cohen, G. (1979). Language comprehension in old age. *Cognitive Psychology, 1,* 412-429.

Cohen, G., & Faulkner, D. (1981). Memory for discourse in old age. *Discourse Processes, 4,* 253-265.

Cohen, G., & Faulkner, D. (1986). Memory for proper names: Age differences in the retrieval. *British Journal of Developmental Psychology, 4,* 187-197.

Craik, F. I. M., & Jennings, J. M. (1992). Human memory In F. I. M. Craik & T. A. Salthouse (Eds.), *The handbook of aging and cognition* (pp. 51-110). Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Craik, F. I. M., & Rabinowitz, J. C. (1984). Age differences in the acquisition and use of verbal information: A tutorial review. In H. Bouma & D. C. Bouwhuis (Eds.), Attention and performance X. Control of language processes (pp. 471-499). Hillsdale, NJ: Lawrence Erlbaum.

Crowe, S. F. (1992). Dissociation of the frontal lobe syndromes by a test of verbal fluency. *Journal of Clinical and Experimental Neuropsychology, 14,* 327-339.

Davis, G. A., & Ball, H. E. (1989). Effects of age on comprehension of complex sentences in adulthood. *Journal of Speech and Hearing Research,* Volume *32,* **143-**150.

Dixon, R. A., Hultsch, D. F., Simon, E. W., & Voneye, A. (1984). Verbal ability and text structure effects on adult age differences in text recall. *Journal of Verbal Learning and Verbal Behavior, 23,* 569-578.

Dordain, M., Nespoulous, J. L., Bourdeau, M., & Lecours, A. R. (1983). Capacities verbales d'adultes normaux soumis a un protocole linguistique de I'aphasie. *Acta Neurologica Belgica, 83,* 5-16.

Dorze, G. L., & Bedarol, C, (1978). Effects of age and education on the lexico-semantic content of connected speech in adults. *Journal of Communication Disorder, 31,* 53-71.

Dowries, J. J., Roberts, A. C, Sahakian, B., Evenden, J. L., Morris, R. G., & Robbins, T. (1989). Impaired extra-dimentional performance in medicated and unmedicated Parkinson's disease: Evidences for specific attentional dysfunction. *Neuropsychologia, 27,* 1329-1343.

Elinski, E. M., & Gilewski, M. J. (1988). Memory for prose in aging: A meta-analysis. In M. L. Howe & C. J. Brainerd (Eds.), Cognitive development in adulthood (pp. 133-160). New York: Springer-Verlag.

Emery, O. (1985). Language and aging. *Experimental Aging Research, 11,* 3-60.

Eriksen, C. W., Hamlin, R. M. & Daye, C. (1973). Aging adults and rate of memory scan. *Bulletin of the Psychonomic Society, 1,* 259.

Eslinger, P. J., & Grattan, L. M. (1993). Frontal lobe and frontal-striatal substrates for different for different forms of human cognitive flexibility. *Neuropsychologia, 31,* 17-28.

Evrard, M., (2002). Aging and lexica access to common and proper names in picture naming. *Brain and Language, 87, 1*74-179.

Farmer, A. (1990). Performance of normal males on the Bostan Naming Test and the word test. *Aphasiology, 4,* 187-196.

Flicker, C, Ferrish, S. H., Crook, T., & Bartus, R. T. (1988). Implication of memory and language dysfunction in the naming deficit of the senile dementia. *Brain and Language, 31,* 187-200.

Frederiksen, C. H., Bracewell, R. J., Breuleux, A., & Renaud, A. (1990). The cognitive representation and processing of discourse: Function and dysfunction. In Y. Joanette & H. H. Brownell (Eds.), Discourse ability and brain damage: Theoretical and empirical perspective (pp. 69-110). New York: Springer-Verlag.

Fridriksson, J., Morrow, K. L., Mosser, D., & Baylis, G. C, (2006). Age-related variability in cortical activity during language processing. *Journal of Speech Language and Hearing Research,* Volume *49,* 690-697.

Goodglass, Ff. (1980a). Naming disorders in aphasia and aging. In L. K. Obler & M. L. Albert (Eds.), *Language and communication in the elderly,* 37-45. Toronto: Lexinton Books.

Goodman, P. (1984). Language pathology in non-Alzheimer dementia. In J. Maxim & K. Bryan (Eds.), Language of the Elderly: A clinical Perspective (pp. 170). Whurr Publication Ltd, London.

Gorden, S., (1986). Effects of aging on response criteria in speech-recognition tasks. *Journal of Speech and Hearing Research,* Volume *29,* 155-162.

Graesser, A. C, Millis, K. K., & Zwaan, R. A. (1995). Inference generation and the construction of situation models. In C. A.

Handler, P. (1960). Radiation and aging. In N. W. shock (ed.), *Aging: Some social and biological aspects.* Washington, DC: American Association for the advancement of Science.

Hasher, L., & Zacks, R. T. (1988). Working memory, comprehension, and aging: A review and a new view. In G. Bauer (Ed.), *Advances in research and theory: The psychology of learning and motivation* (Vol. 22, pp. 193-225). New York: Academic Press.

Hill, R. D. (1993). Prediction of reading performance in college-educated older adults. *Educational Gerontology, 19,* 21-30.

Hotz, G., & Helm-Estabrooks, N. (1995). Perserveration: Part I; A review. *Brain Injury, 9,* 151-159.

James, R. L. (1964). *Edmonton senior resident's survey report.* Edmonton Welfare Council, Edmonton, Alta.

Kaplan, E., Goodglass, H., & Weintrab, S. (1976). The Bostan Naming Test. Experimental edition.

Kaplan, E., Goodglass, H., & Weintrab, S. (1983). *The Bostan Naming Test.* Philadelphia: Lea & Febiger.

Kempler, D., Curtiss, S., & Jackson, C. (1987). Syntactic preservation in Alzheimer's disease. *Journal of Speech and Hearing Disorders, 30,* 343-350.

Kempler, D., Van Lancker, D., & Read, S. (1988). Proverb and idioms comprehension in Alzheimer's disease. *Alzheimer's disease and Associated Disorders, 2,* 38-49.

Kemper, S. (1992). Language and aging. In F. I. M. Craik & T. A. Salthouse (Eds.), *The handbook of aging and cognition* (pp. 213-270). Hillsdale, NJ: Lawrence Erlbaum Associates.

Kynette, D., & Kempler, S. (1986). Aging and loss of the grammatical forms. *Language and Communication, 6,65-72.*

LaBarge, E., Edwards, D., & Knesevich, J. W. (1986). Performance of normal elderly on the Bostan Naming Test. *Brain and Language, 27,* 380-384.

LeDorze, G., & Durocher, J. (1992). The effects of age, education level, and stimulus length on naming on normal subjects. *Journal of Speech-Language Pathology and Audiology, 16,21-29.*

Light, L. (1990). Interaction between memory and language in old age. In J. E. Birren & K. W. Schaie (Eds.). Handbook of the psychology of the aging (pp. 275-290). New York: Academic.

Light, L., & Anderson, P. A. (1985). Working memory capacity, age, and memory for discourse. *Journal of Gerontology, 40,* 737-747.

Lous, K. R., (2000). Category-specific naming errors in normal subjects: The influence of evolution and experience. *Brain and Language, 75,* 123-133.

Margolin, D. I., Pate, D. S., & Friedrich, F. J., (1996). Lexical priming by pictures and words in normal aging and in Dementia of Alzheimer's type. *Brain and Language, 54,* 275-301.

Mayer, B. J. F. (1987). Reading comprehension and aging: In K. W. Schaie & C. Eisdorfer (Eds.), *Annual review of gerontology and geriatrics* (pp. 93-115). New York: Springer.

Mayeux, R., Stern, Y., Sano, M., Cote, L., & Williams, J. B. W. (1987). Clinical and biochemical correlates of Bradyphrenia in Parkinson's disease. *Neurology, 37,* 1130-1134.

Medvedev, Z. A. (1964). The nucleic acids in development and aging. *Advances in Gerontological Research, 1,* 181-202.

Metz-Lutz, M. N., kremin, H., Deloche, G., Hannequin, D., Ferrand, I., Perrier, D., Quint, S., Dordain, M., Bunel, G., Cardebat, D., Larroque, C, Lota, A. M., Plchard, B., & Blavier, A. (1991). Standardisation d'un test de denomination orale: Controle des effectsde I'age, du sexe at du nlveau de scolarite chez les sujets adultes normaux. *Revue de neuropsychologie, 1,* 73-95.

Mitchell, D. B. (1989). How many memory systems? Evidence from aging. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 15,* 31-49.

Montgomery, K., & Costa, L. (1983, February). Neuropsychological test performance of a normal elderly sample. Paper presented at the Eleventh annual meeting of the International psychological Society, Mexico City, Mexico.

Nebes, R. (1985). Preservation of semantic structures in dementia. In H. Ulatowska (Ed.), The aging brain: *Communication in the elderly.* Austin, TX: PRO-ED.

Newell, C. D., Peterka, R. J., Black, F. O., & Schoenhoff, M. B. (1987). Age-related changes in human vestibulocular and vestibulospinal reflex. *Association for Research in Otolaryngology Abstracts,* 10, 112.

Nicholas, L. E., Brookshire, R. H., MacLennan, D. L., Schumacher, J. G., & Porrazzo, S. A. (1989). The Bostan Naming Test: Revised administration and scoring procedures and normative information for non-brain damaged adults. *Clinical Aphasiology, 18,* 103-115.

Nicholas, N., Obler, L., Albert, M, & Goodglass, H. (1985). Lexical retrieval in healthy aging. *Cortex, 21,* 595-606.

Obler, L. K. (1980). Narrative discourse style in the elderly. In L. K. Obler & M. L. Albert (Eds.), Language and communication in the elderly. Lexington, MA: D. C. Heath.

Obler, L. K., & Albert, M. L. (1985). Language skills across adulthood. In J. Birren & K. W. Schaie (Eds.), Handbook of the psychology of the aging. New York: Van Nostrand Reinhold.

Obler, L. K., Nicholas, M. Albert, M. L.& Woodward. S. (1985). On comprehension across the lifespan. *Cortex, 21,* 273-280.

Poon, L. W. (Ed). (1980). Aging in the 1980s. Washington DC: American Psychological Association.

Rastatter, M. P., & Brill, C. L., (1987). Reaction time of aging subjects to monaural verbal stimuli: Some evidences for a reduction in right-hemisphere linguistic processing capacity. *Journal of Speech and Hearing Research,* Volume *30,* 261-267.

Richards, M., Cote, I. J., & Stern, Y. (1993). Executive function in Parkinson's disease: Set shifting or set-maintenance? *Journal of Clinical and Experimental Neuropsychology, 15,* 266-279.

Rogers, D. (1986). Bradyphrenia in Parkinsonism: A historical review. *Psychological medicine, 16,* 257-265.

Rosen, W. (1980). Verbal fluency in aging and dementia. *Journal of clinical Neuropsychology, 2,* 135-146.

Rosselll, M., Ardila, A., & Rosas, P. (1990). Neuropsychological assessment in illiterates. II. Language and praxic abilities. *Brain and Cognition, 12,* 281-296.

Russell, E. W. (1975). A multiple scoring method for the assessment of complex memory function. *Journal of Consulting and Clinical Psychology, 43,* 447-450.

Salthouse, T. A. (1991). Theoretical perspective on cognitive aging. Hillsdale: Lawrence Eribaum.

Schonfield, D., & Robertson, B. A. (1966). Memory storage and aging. *Canadian journal of psychology, 20,* 228-236.

Seamon, G. A., & Luo, C. R., Schlegel, S.E., & Goldenberg, A. B. (2000). False memory for categorical pictures and words: The category associated procedures for studying memory errors in children and adults. *Journal of Memory and Language, 42,* 120-146.

Shipp, T., Izdebski, K., & Morrissey, P., (1984). Physiologic stages of vocal reaction time. *Journal of Speech and Hearing Research,* Volume *27,* 173-176.

Thomas, J. C, Fozard, J. L., & Waugh, N. C. (1977). Age-related differences in naming latency. *American Journal of Psychology, 90,* 499-509.

Thulllard, F., & Assal, G. (1989, May). Bilan neuropsychologique chez le sujet age. Paper presented at the meeting of the Societe de Neuropsychologie de Langue Francaise, Grenoble, France.

Tompkins, J. G., Boada, R., & McGarry, (1992). The access and processing of familiar idioms by brain damaged and normally aging adults. *Journal of speech and Hearing Research,* Volume *35,* 626-637.

Tweedy, J. R., & Schulman, P. D. (1982). Towards a functional classification of naming impairments. *Brain and Language, 15,* 193-206.

Ulatowska, H. K., Cannito, M. P., Hayashi, M. M. & Flemming, S. G. (1985). Language abilities of the elderly. In H. K. Ulatowska (Eds.), The aging brain: Communication in the elderly (pp. 125-139). Austin, TX: PRO:ED.

Van Gorp W., Satz, P., Kiersch, M. E., & Henry, R. (1986). Normative data on the Bostan Naming Test for a grou *, 8,* 702-705.

Varley, R. (1995). Lexical-semantic deficits following right hemisphere damage: Evidences from verbal fluency tasks. *European Journal of Disorders of Communication, 30,* 362-371.

Villardita, C, Cultera, S., Cupone, V., & Mejia, R. (1985). Neuropsychological test performances and normal aging. *Archives of Gerontology and Geriatry, 4,* 311-319.

Walker, M. M., Barrow, I., & Rastatter, M. P. (2002). The effect of dimension and vocabulary age on rapid naming in children. *Journal of Communication Disorder, 35,* 1-10.

Walker, V., Hardiman, C, Hedrick, D., & Holbrook, A. (1981). Speech and language characteristics of an aging population. In N. Lass (Ed.), *Speech and Language: Advances in basic research and practice.* New York: Academic Press.

Whitehouse, P. J. (1986). The concept of subcortical and cortical dementia: Another look. *Annals of Neurology, 19,* 1-6.

Wilson, R. H. (1981). The effects of aging on the magnitude of the acoustic reflex. *Journal of Speech and Hearing Research, 24,* 406-414.

Worrall, E. L., & Hickson, M. L.,(2003). Communication disability in aging from prevention to intervention. Delmar learning singular Inc. New York.

Wright, H. H., & Newhoff, M. (2002). Age related differences in inference revision processing. *Brain and Language, 80,* 226-239.

Wulfeck, B. B. (1993). A reaction time study of grammaticality judgment in children. *Journal of Speech and Hearing Research,* Volume 36, 1208-1215.

APPENDIX

1. /elephant/, /snake/, /tiger/, **/apple/,** /lion/

2. /blue/, /orange/, /green/, /red/, **/hand/**

3. /teacher/, **/tap/,** /police/, /tailor/, /barber/

4. /train/, /bus/, **/mosquito/,** /auto/, /car/

5. /spoon/, /glass/, /plate/, /knife/, **/rose/**

6. /shirt/, /dhoti/, /pant/, **/fan/,** /cap/

7. /crow/, **/boy/,** /owl/ /peacock/, /parrot/

8. /brinjal/, /ladyfinger/, /potato/, **/chair/,** /onion/

9. /mango/, /**egg/**, /banana/, /grapes/, /papaya/

10. /cat/, /monkey/, /cow/, /dog/, **/cycle/**